Docket No.: 29137.096.00
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Dong-seok KIM et al.

Application No.: 10/550,591

Filed: September 13, 2006

For: TRANSPARENT, HIGHLY HEAT-RESISTANT POLYIMIDE PRECURSOR AND PHOTOSENSITIVE POLYIMIDE COMPOSITION THEREOF

Customer No.: 30827

Confirmation No.: 1374

Art Unit: 1796

Examiner: Gregory Listvoyb

MS RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR § 1.132

Sir:

I, the undersigned, Kyung-jun KIM, willfully make the following declaration:

1. I am a co-inventor of the invention described and claimed in U.S. Patent Application No. 10/550,591 (the '591 Application) for Transparent, Highly Heat-Resistant Polyimide Precursor and Photosensitive Polyimide Composition Thereof.

2. I am familiar with the specification and claims of the '591 Application.

3. I conducted experiments to evaluate chemical resistance and planarization of the polyimide films formed by the Preferred Embodiments 1-3 and the Comparative Examples 1-3 in the specification of the '591 Application. As described in the specification of the '591 Application, chemical resistance and planarization were measured by the following methods;

<Evaluation of Chemical Resistance>

Chemical resistance is examined by observing the change in the thickness when the films are dipped into chemicals (10% NaOH aqueous solution, 10% HCl aquetous solution, and NMP).

$$\text{Ratio of change in thickness} = \frac{\text{(Film thickness before treatment - Film thickness after treatment)}}{\text{(Film thickness before treatment)}} * 100(\%)$$

<Evaluation of Planarization>

For evaluation of the degree of planarization, 10 μm Line/ 10 μm Space (1:1) repetitive pattern with 1.0 μm step height before coating is used.

$$\text{Degree of planarization} = \left(1 - \frac{\text{Step height after coating}}{\text{step height before coating}}\right) * 100(\%)$$

4. The results of the Evaluation of Chemical resistance and Planarization are shown in the following table.

Composition	Chemical resistance	Degree of planarization
Preferred Embodiment 1	≤ ±3 %	≥ 70 %
Preferred Embodiment 2	≤ ±3 %	≥ 70 %
Preferred Embodiment 3	≤ ±3 %	≥ 70 %
Comparative Example 1	> ±3 %	< 70 %
Comparative Example 2	> ±3 %	< 70 %
Comparative Example 3	> ±3 %	≥ 70 %

5. I analyzed and evaluated the above Chemical resistance and Planarization by the following criteria as described in the specification of the '591 Application and the result of this evaluation was shown in Table 1 of the '591 Application.

<Evaluation of Chemical Resistance>

When the ratio of change in thickness after dipping into chemical substances at room temperature for 1 hour is within ±3%, it is defined to be superior; when it exceeds that range, it is defined to be inferior.

<Evaluation of Planarization>
If degree of planarization is greater than 70%, it is defined to be superior; if it is less than that, it is defined to be inferior.

6. I read and understood the Office Action of November 20, 2009 and its cited references, US Patent Application Publication No. 2002/0093077 to Jung et al. ("Jung") and US Patent Application Publication No. 2002/0055610 to Okada et al. ("Okada").

7. I conclude that the diamines, such as 3,5-diaminophenyl cinnamate, which are disclosed in Okada cannot be combinable with Jung's positive-type photosensitive polyimide precursor.

8. Generally, positive-type photosensitive polyimide precursor is not soluble in alkali solution. Here, the solubility of the polyimide precursor is closely related to acid value. When an acid value is high, the polyimide precursor will be negative type because it will be easily soluble in the alkali solution.

9. As Jung's polyimide precursor is positive-type, it should not have an acid value enough to dissolve itself in the alkali solution until the light exposure when making a polyimide precursor film. However, if diamines, such as 3,5-diaminophenyl cinnamate, are used in Y of Jung's Fomula (1), the acid value and the solubility to alkali solution will be increased due to the existence of phenyl-cinnamic acid group(Y), and therefore, a positive-type polyimide precursor cannot be obtained.

10. In fact, Jung does not disclose any compound that Y can affect the acid value of the compound. (Jung, paragraph [0061])

11. By the reason above, even though Jung discloses a broad ranges of the acid value, in consideration of its positive type of photosensitive pattern, the acid value of Jung's compound cannot be compatible or consistent to the scope of acid valued defined in the '591 Application.

12. In addition, the polyimide composition of '591 Application shows unexpected properties over Jung's composition. In Comparative Examples 1 and 2 of '591 Application, 4,4-oxydianiline(ODA) was used in Y position. This compound falls within the definition of Jung's compound Y, i.e., Y is a divalent, an aromatic or an aliphatic organic group. However, as shown in Table 1 of '591 Application, the chemical resistance and the degree of planarization of the films of Comparative Examples 1 and 2 are inferior to those of the claimed invention (Preferred Embodiments 1-3). These results are unexpected from the disclosure of Jung's.

13. I declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge of willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Kyungjun Kim

Kyung-jun KIM

Date: April 23, 2010